Environment Canada Environnement Canada

PROCEEDINGS

OF

INLAND WATERS DIRECTORATE

INSTRUMENTATION WORKSHOP '86

MAY 13-14, 1986

INTRODUCTION

The Inland Waters Directorate is the largest group within the Government of Canada who measure, analyze, control, and conduct scientific investigations on Canada's freshwater systems.

With a human resource base of 1200 person years, it is estimated that 125 of these person years are directly or indirectly involved in the development, maintenance, testing and procurement of water related instrumentation and data collection systems.

These staff are divided among the various branches of the Directorate. The **National Water Research Institute** at Burlington, Ontario; the **National Hydrology Research Centre** at Saskatoon, Saskatchewan; the **Water Quality Branch** and the **Water Resources Branch** located at various regional offices across the country.

Although each of these Branches have significantly different operating mandates and equipment requirements, it was found that little communication took place between the various staffs when developing similar equipment or solving similar problems. Very few knew of other individuals in other Branches who were involved in similar work.

To assist in providing a forum so that these staff could meet and learn of the work of others and the availability of facilities and equipment, an ad-hoc committee was formed. This committee organized a workshop which was held on May 13 & 14, 1986.

This document is a record of that workshop with edited summaries of the presentations made.

CHAIRMANS' COMMENTS

The workshop was an eye-opener for many. As engineers, technicians, scientists and support staff we consider ourselves specialists in our respective fields. We are constantly keeping abreast of technology as it applies to our work throughout the world, yet we pay little attention to what is going on in our own backyards. I am quite sure that the workshop provided us all with a good insight into the work of the various groups within IWD and will help to bridge this gap. It was gratifying to see so many people exchanging ideas, discussing concerns and just simply getting to know each others fields of expertise.

Sixty-eight people attended the workshop. Thirty-three from the **NWRI**, sixteen from the **WRB**, three from the **NHRC**, and the remaining sixteen from the **WQB** and regional detachments. The organizing committee considers that the attendees represented a good cross-section of those involved in the field of instrumentations within the Directorate.

At the end of the workshop a panel discussion took place. The two main points raised at that time were:

(1) That an IWD Instrumentation Workshop '88 should be organized with an autumn venue at the NHRC in Saskatoon.
(2) That a list of IWD instrumentation experts be compiled for distribution.

Since no move was made to replace the ad-hoc committee, I'm sure that the present committee will contribute to organize these two projects.

S.D. Baird
NWRI - July 1986

INLAND WATERS DIRECTORATE
INSTRUMENTATION WORKSHOP '86
ORGANIZING COMMITTEE

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KEYNOTE ADDRESS

Mr. David Egar
Director
National Water Research Institute

Let me first of all welcome you to the Canada Centre for Inland Waters.

The Canada Centre for Inland Waters was established during the period of 1967-70. The reason for the formation of such a centre was to provide Canada with a centre of excellence for the research of limnological and associated sciences.

The Centre houses both the Department of Environment and the Department of Fisheries and Oceans.

The National Water Research Institute is the largest occupant of the Centre.

Our work at NWRI covers all facets of the limnological and freshwater sciences. Our programs reach from coast to coast and basically aim at gaining a better scientific understanding of the chemical, biological, hydraulic, geological and physical limnological processes of Canada's freshwater systems and pathways.

In the conduct of our scientific programs, our scientists and support staff are constantly investigating and developing new and novel ways of obtaining and recording data.

As our understanding of the processes increase we find that we are uncovering other processes that only a few years ago were unheard of.

With this ever increasing effort to obtain more detail of the processes, we have developed a constant need to keep abreast of the state-of-the-art in data collection instrumentation.

It was only 15 years ago that instrumentation breakthroughs provided us with the ability to measure parameters in the parts per thousand ranges. However, as our scientists develop a better understanding of the parameters, we now question if measurements in the parts per billion ranges are sufficient.

Over the past 20 years we have developed numerous data collection instruments here at NWRI to satisfy our need to know more. It has been an uphill battle.

As the engineers and designers develop a new system, the science quickly catches up to its abilities, and there becomes a need to develop a newer system.

We have been quite fortunate, however, that our design staff have kept abreast of technology; especially in the areas of modern day micro-processors and extremely low power stable electronics circuitry and exotic mechanical materiels.

This has assisted us in maintaining our status as one of the foremost centres of excellence in our field in the world.

With this ongoing instrumentation development at NWRI we have created many spin-offs from our day to day work.

We have had to develop our facilities to accommodate this work. We have well-equipped design laboratories, manufacturing workshops, calibration and testing laboratories and modern computer assisted engineering systems.

We have worked with industry in the National Research Council's PILP program; with the Department of Supply and Services unsolicited proposal program; and in the creation of contractors and facilities locally, to assist us in our work.

Within the Inland Waters Directorate a significant amount of resources is expended each year on instrumentation development and instrumentation maintenance.

It would appear that from informal contacts between the various Branches' instrumentation staff, that each group does not have a good understanding of the others' work.

It is to this end the NWRI took the initiative to gather you here in Burlington for the next two days to discuss your general instrumentation work, and where possible, to outline instrumentation problems that you may face.

We have experienced situations where we are tackling a problem that one of you have solved. And we have found situations where you have a problem that we solved some time ago.

The intention of this Workshop is to gather you all together to provide you with a vehicle to get to know each other and what each other's expertise area may be; to find out about facilties within IWD, and most importantly, to learn from each other.

I have had a detailed look at the agenda for the next two days, and I feel sure that a lot of interesting knowledge will be obtained by all of you.

I wish all of you a successful two days at the Canada Centre for Inland Waters. Please do take advantage of the laboratory tours that have been organized for you.

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NATIONAL WATER RESEARCH INSTITUTE SESSION
CHAIRMAN: F.E. ROY

NWRI BRANCH OVERVIEW - F.E. ROY

Research activities of the five science divisions of the Institute were briefly described and examples of equipment and instrumentation used were shown. Support facilities of the Technical Operations Division and the Engineering and Manufacturing and Technology Sections were also described, with emphasis on calibration, environmental testing and machine shop.

Microprocessor Applications at NWRI - J. Dolanjski - Manufacturing and Technical Development Section

Microprocessors are electronic components that can perform many logical and mathematical functions based upon the software program that controls them. The utilisation of microprocessors in circuit design has many advantages: flexibility, programmability, easy math functions, reliability and compactness. The microprocessor design at the NWRI is carried out with an IBM PC computer where the program is developed, cross-assembled, simulated, de-bugged and "burned in" to the chip. Some projects using microprocessors were described: Programmable Timer, Multi-Wavelength Identification Scanner, Dissolved Oxygen Profiler, Data Logger Interrogator, Sectional Sampler and Price Current Meter Indicator.

Lake Surveillance Instrumentation and Future Requirements - E.G. Smith - Technical Operations Division

The historical evolution of lake surveillance instrumentation was reviewed, using temperature - depth measurement as the example. Similarly, the techniques for water sampling were discussed, showing the evolution to large scale sampling using rosette bottle systems. Development of surveillance winches and a combination of several sensors on a single sonde were shown as one method for increasing the efficiency of lake surveillance operations.

Instrumentation started with the mechanical bathythermograph and Vandorn bottles with a meter wheel readout for depths and has developed into the present day technology of the electronic bathythermograph and multi-bottle array Rosette system for water samples and electronic systems for control of winches.

Present day technology of modular electronic packing has allowed the design of temperature-depth profiler systems of a suitable size for portable field applications.

Future development requirements for multi-parameter profiling is multiplexing to limit cable size, usage of fibre optic technology and computer control acquisition system data loggers.

Instrumentation for Physical Limnology - J. Bull - APSD

An overview was given of the types of instrumentation packages deployed in physical limnology studies. In general, such instrumentation is designed for automatic recording of time series data of physical parameters. These are deployed as submersible packages, or mounted as buoy or tower packages typically for periods of a few months. The current bias is towards data loggers with burst sampling, threshold triggering, and high data storage capacity.

Multi-Parameter Sensing in Lakes - J.S. Ford and M. Charlton - ENSRVS and AED

In the early 1980's, work began on two projects which later converged to produce a highly successful profiler to gather oxygen and temperature data on the lower Great Lakes. The Yellow Springs Instrument Company produce oxygen and temperature probes which can be used in a profiling mode. These were incorporated into a sonde that operates off AC power directly and telemeters its data up the power wires to a microcomputer. The flexibility of this system has been valuable in providing accurate and well controlled data. Most significantly, the microcomputer recalibrates the oxygen probe before each profile and controls the speed of the winch to avoid losing detail from the oxygen layers while keeping the profiling time to a minimum. Other features provided by the computer are immediate graphical presentations, compact storage on floppy diskettes, and prompts to the operator. After the profiling is complete, the data may be preprocessed to correct for lag effects caused by the oxygen probe and to average out the noise and variability caused by wave motions during the profiling operations.

Scientifically, the new apparatus provides information which was previously difficult or impossible to obtain. Details of the oxygen profiles caused by seasonal stratification are now visible. Early results show that there is usually little or no gradient related to sediment oxygen consumption in Lake Erie. Other profiles show an oxygen depression of up to 4 mg/L in the thermocline of Eastern Lake Erie. The profiler allows an exact determination of the depth to sample for biological causes. When the thermocline is close to the bottom, the profiler is the only reliable method to measure oxygen conditions. Results from the profiler agree well with the Winkler method except when traditional bottle sampling methods fail in sharp thermoclines. For routine data gathering, the method is sufficiently accurate and savings in lab work and transcription procedures are apparent.

Instruments and Techniques for Grain Size Analysis - K. Salisbury - HD

A description of the theories and techniques for determining grain size in river and lake sediments was presented. The methods discussed included sieving sands and gravels, settling techniques for sands, sedigraph instruments for silts and clays, and the Malvern laser instrument for suspended materials.

Towards a Better Suspended Sediment Sensor - R. Desrosiers - ENSRVS

A brief review of existing techniques to measure suspended sediment was given. Results of modelling transmittance sensor performance were given in some detail. New sensors based on particle counting technology were proposed.

Instruments for the Study of Toxic Deposition - Dr. W. Strachan and Dr. D. Jefferies - ECD

The requirement for the measurement of organic contaminants in precipitation was explained by Dr. Strachan. Methods and equipment for rain fall collection and on site extraction of organics were described. The required future development is to extend these techniques to the collection and processing of snow and ice precipitation. A developmental model of a year round precipitation collector was described, and the problems discovered during the first field evaluation were reviewed with a discussion of possible solutions.

Dr. Jefferies described work in the study of the movement of contaminants from the snow pack into the ground water system during periods of snow melt. The field set-up was shown, featuring an instrument dug out, below the ground surface, with a shield box and funnel to isolate a segment of the snow pack and capture the snow melt

from the segment. Modifications to an Ipsco sampler to convert it to a microprocessor controlled sectional sampler of the snow melt, with time and date logging capability were described. Some observations based on field operations were discussed.

Interval Sampling Requirements - Dr. J. Carey - ECD

The monitoring of organic contaminant loads in streams was described. Water samples of tens of litres in volume are required in order to extract sufficient contaminant for analysis. On site extraction of the contaminant is required since the cost of transporting large water samples to the laboratory is prohibitive. Liquid solvent and resin column extraction techniques were reviewed. Although liquid solvent techniques are preferred, resin column techniques are more practical for field applications. The need for interval sampling of the stream flow was illustrated by data showing that the contaminant load varies significantly during the daily cycle, and also spatially with distance down stream of the source. Preliminary specifications of an interval sampling system to address future requirements for monitoring contaminant loads in larger river systems were described.

WATER QUALITY BRANCH SESSION
CHAIRMAN: DR. DEMAYO

WQB OVERVIEW - DR. DEMAYO

A brief description of the branch organization and responsibilities was given. The National Network was described. The problems with instrumentation reliability, the availability of "OFF-THE-SHELF EQUIPMENT", sources of reliable contractors, and future plans for equipment development work were discussed.

Evolution of Field Water Quality Data Collection Systems in WQB/AR - R. Bingham - Atlantic Region

The Water Quality Branch Atlantic Region has been involved in various aspects of automatic water quality monitoring since 1970. At that time several units where placed at locations in the Saint John basin.

This network operated year round, used a pumped delivery system and measured conductivity, pH, D_O, water temperature and turbidity.

The network provided many operational problems and the following observations were made:

1. The pumped delivery system was costly to install as well as difficult and costly to maintain.
2. The cost of year round operation was high and the largest percentage of the cost was due to winter operation.
3. Accurate measurements require continuous cleaning of the probes (once per day). This system did not provide for automatic cleaning therefore several weeks often passed between manual cleaning.

4. A method of inserting a calibration check for each parameter is desirable to increase confidence in the measured data. Such capability was not a part of this system and relied on visits to the site.
5. Automatic replenishment of those probes using electrolyte is necessary for unattended use.

Subsequently a Philips automatic monitor was purchased. This monitor provided for automatic ultrasonic cleaning, periodic introduction of calibration standards and continuous probe electrolyte replenishment. The unit gave a significant increase in the percentage of reliable data, however operational problems persisted. The timing mechanisms were electro-mechanical and were prone to misalignment. Spare parts were difficult and sometimes impossible to obtain. The use of digital electronics for timing would have improved the reliability of this unit.

The network was disbanded in 1978, however, two units were maintained for special studies.

WQB began to look towards the more portable submersible type monitor. In 1983 a Montedoro-Whitney in-situ probe package was purchased as well as a Handar satellite retransmission platform for telemetry.

This combination permits battery operation with solar recharging ideal for use in remote locations. In-situ monitors however preclude automatic cleaning and calibration therefore the applications for this type of monitor have to be carefully selected.

All probes for this unit are housed in one package. Some shared electronic circuitry can cause failures in one signal conditioner that often affect the others.

Advances in technology have allowed complete signal conditioning circuits to be built into a single probe housing. Such a probe set was purchased from Enviro-Labs in 1985. Each probe is driven by a 12 volt source and a 0-5 v signal is provided at the end of the signal cable (up to 100 metres).

This probe set (conductivity 0-500 uS/cm, pH, and temperature) was directly connected to the Handar D.C.P. and was placed in the Mersey River during the winter of 1985-86. Better than 90% data recovery was experienced between October 1985 and May 1986.

As opposed to networks AWQM's are useful in special projects. Grab sampling in conjunction with AWQM's could provide excellent temporal and spatial capability including short term fluctuations of water quality parameters which are important to the biological community.

The portability and low power drain of recent in-situ monitors combined with the very reliable satellite data collection platforms provides an economic and practical method of continuous water quality data collection.

Continuous Field Sampling For Analysis of Toxic Compounds in WQB-OR
R. McCrea - Ontario Region

A continuous sampling system for organic contaminants in water and suspended sediment was installed at the Niagara-on-the-Lake monitoring station. The sampling system consists of five major components: a multi-line intake, a centrifuge feed pump, a continuous flow centrifuge, an extractor feed pump and a mixer-settler extractor. Water is drawn from the Niagara River at a flow rate of 15-20L/min., with a magnetically driven submersible pump. Typically, raw water from this supply is delivered at a rate of 1L/min. to a Westfalia centrifuge, with a micrometer controlled peristaltic pump. The Westfalia centrifuge

exerts a force of approximately 9500 g, and it has been shown to be effective in the recovery of suspended sediments with particle sizes finer than 0.2 micron (Thomas and McMillan, 1978). Clarified water is drawn at a rate of 10 mL/min. from the centrifuge effluent, using a piston pump and extracted with a dichloromethane based mixer-settler extractor (Goulden and Anthony, 1986). The system is run continuously for seven consecutive days yielding a composite seston sample derived from approximately 10,000L of raw water and an aqueous phase extract equivalent to 100L of clarified water. The accuracy of the centrifuge and extractor feed pumps over a one-week sampling period are + 3% and + 1% respectively (McCrea and Fischer, 1984).

The operation of the continuous sampling system is monitored and controlled with several devices to overcome problems which arise from power outages, low voltage, pump failure and excessive vibration of the centrifuge. In the event of a power outage, the centrifuge will restart immediately upon resumption of power, however, the water delivery and extraction systems are delayed to allow the centrifuge to attain full operating speed prior to recommencing sampling. Should the magnetically driven submersible pump fail, a back-up pump will start automatically, and therefore, enable the system to continue sample collection.

Calibration et Evaluation de la Centrifugeuse Westfalia et de l'Echantillonneur d'eau Seastar - André Germain - Région du Québec

Au début de 1984, nous avons fait l'achat d'une centrifugeuse Westfalia et d'un échantillonneur d'eau Seastar. Avant d'employer ces 2 appareils sur le terrain, nous en avons fait la calibration au laboratoire.

Le rendement de la centrifugeuse a été évalué à différents débits d'admission d'eau, tant pour le pourcentage de retention des particules en suspension dans l'eau que pour le spectre de taille des solides retenus. Pour des teneurs de matières solides dans l'eau inférieures à 10 mg/l, nous avons obtenu des retentions passant de 92 ± 3% à un débit d'admission d'eau de 0,5 l/min à 81 ± 1% pour un débit de 6,5 l/min. En ce qui concerne le spectre de taille des particules, nous avons observé que l'augmentation du débit d'admission causait une perte importante des solides ayant un diamètre supérieur à 2 µm.

L'échantillonneur Seastar peut fonctionner selon 12 modes d'échantillonnage, à 3 débits différents. Après une première vérification, l'appareil a été retourné à Seastar pour une mise au point. La compagnie a changé toutes les composantes mécaniques et électroniques internes de l'appareil. Lorsqu'il nous est revenu, nous avons vérifié les modes 2, 3, 7, et 8 de l'échantillonneur. Ces modes correspondent à différents temps de pompage. Globalement l'appareil a bien fonctionné. L'écart entre le volume pompé et le volume indiqué à l'appareil a été inférieur à 1% et les intervalles de temps d'échantillonnage ont été respectées.

Du côté chimique, nous avons fait des tests récupération pour les PCB et pour les organos-chlorés. Nous avons vérifié l'effet de lessivage de la colonne et l'effet du débit de pompage. Nous avons pompé des solutions de 10, 18 et 36 L à des débits de 50, 100 et 150 ml/min. La concentration des différents composés chimiques était de 10 ng/l pour chacun. Globalement, il n'y a pas eu d'effect dû au volume pompé ou au débit de pompage sauf pour l'heptachlor, l'aldrine, le pp'-DDE et le ⍺-BHC. Pour l'ensemble des composés organo-chlorés, nous avons obtenu une récupération de 94 ± 19% et de 80 ± 13% pour les PCB.

Nous avons fait deux essais sur le terrain. Le premier à l'automne de 1984 et le second à l'automne de 1985. Nous avons couplé les 2 appareils en série. Le Seastar recevait l'eau de rejet de la centrifugeuse. Lors de notre campagne d'échantillonnage, les 2 appareils se sont comportés comme il avait été prévu, suite aux

calibrations en laboratoire. Nous avons retrouvé des PCB et certains organo-chlorés dans les sédiments en suspension. Dans la fraction dissoute, nous avons retrouvé sensiblement les même produits, à l'exception des PCB qui étaient absents.

Un test ultérieur en laboratoire a jeté un doute sur nos résultats pour la fraction dissoute dans l'eau. Nous avons observé que le filtre en fibre de verre, recommandé par le manufacturier pour retenir les matières en suspension présentes dans l'eau, captait de 20 à 100% des produits présents sous forme dissoutes (100% pour la famille des DDT, 90% pour les chlordanes, etc...). Seuls l'α , le β-BHS, l'α et le β-endosulfane, l'endrine et le dieldrine n'étaient pas retenus par le filtre.

Nous pouvons conclure que la centrifugeuse fonctionne très bien; que la partie mécanique et chimique de l'échantillonneur d'eau Seastar est obtenu par différents auteurs dans la littérature, sauf pour le β-BHC; que le couplage entre les 2 instruments fonctionne bien. Par contre, le filtre en fibre de verre doit être changé pour un filtre qui ne retiendra pas les composés que l'on veut mesurer.

REFERENCES

Roche Associés Ltée, juin 1985. Mise au point de l'application de la méthode de centrifugation en continu pour l'échantillonnage des solides en suspension et de la méthode de pompage à travers une colonne de résine absorbante pour l'échantillonnage de l'eau. 123 p. (Couture, R., Caron, J., Leblanc, R.).

Couture, R., et Caron, J., mai 1986. Mise au point de l'application de la méthode de pompage à travers une colonne de résine absorbante pour l'échantillonnage de l'eau. Les consultants Sogeam Inc. 94 p. plus annexes.

Water Quality National Laboratory Developments and Future Needs For WQNL Instrumentation - R.C.J. Sampson

A significant proportion of Water Quality Branch activities are predicated on high technological analytical chemistry laboratory support. Most of the instrumentation used is obtained commercially and represents the culmination of considerable research and development on the part of scientific equipment suppliers.

In large measure, this instrumentation, while very complex, sophisticated and expensive, is used only in the final determination of identity and quantity of the target analyte. Analytical chemistry procedures used to separate the material in question from various environmental substrates, to concentrate it and render it suitable for instrumental determination represent the rate determining steps in the overall analytical process. There is an excellent opportunity to apply modern, computer-based instrument technology to the many tedious and time consuming elements of the overall analytical process and realize significant savings in manpower while increasing sample throughput. This approach could also introduce a degree of reproducibility not attainable with the human operated equivalent, resulting in a correspondingly reduced quality assurance effort.

The "bread and butter" analytical technologies presently in use in the Water Quality National Laboratory (WQNL) are discussed in the environment of a modern, heavily instrumented analytical facility. Rate limiting components of heavily used procedures are identified with a view to generating interest for initiating development activities that will address these and assist the WQNL in providing more cost effective analytical support to Water Quality Branch and other Departmental programs nationally.

Automatic water Quality Data Acquisition In The Pacific and Yukon Region - Norman Dalley

The experience in the Pacific and Yukon Region with automatic water quality data acquisition is described. The rationale for our studies, our experience with the Hydrolab and our specifications for a new water quality data acquisition system are detailed. Recently, we embarked on a long term study of a selected suite of water quality variables in a Pacific coastal stream using automatic data acquisition. The purpose of this study was to develop appropriate methods of monitoring water quality in coastal streams. Two of the objectives of the study were first, to acquire a low cost, versatile water quality monitoring system that could be used for attended or unattended monitoring and for remote data transfer. Secondly, to evaluate the performance of data acquisition systems in the field under long term monitoring conditions. The desirable features we have identified for a data acquisition device are discussed. A Canadian company, Applied Instrumentation, Inc. has designed two generalized data acquisition systems called the Microscout and Terra B which meet most of the criteria. These systems are described as are the water quality sensors we have selected and some of the other sensors currently available. The system is low cost (<$5000 U.S.), flexible (up to 32 different sensors with several different types of triggers), rugged and has a wide temperature operating range. Setup is straight forward and quickly performed. The manufacturer was very cooperative in trying to meet our particular needs and is able to service the units in Vancouver.

NATIONAL HYDROLOGY RESEARCH CENTRE
CHAIRMAN: R.O. CHRISTIE

NHRC BRANCH OVERVIEW - R.O. CHRISTIE

The various instrumentation Systems developed for NHRC scientific surveys over the past 10 years was briefly discussed with emphasis on winter ice equipment. The modifications to "OFF-THE-SHELF" equipment for NHRC specific applications was detailed. Some discussions of scientific staffs' work took place. A slide presentation of the new institute was made with particular reference to environmental test chambers and instrumentation laboratories.

Instrumentation Associated with the Mackenzie Delta Lake Regimes Study - Steven C. Bigras

A description of the Lake Regimes Study, Mackenzie Delta, NWT, is given. Problems associated with monitoring water levels during break-up are reviewed. Special equipment and measurement techniques developed to overcome these problems are highlighted.

Continued expansion of the data base increased the need for accurate, yet, portable instrumentation. A modified Microfix system developed to conduct lake and channel bathymetry is presented.

Ever increasing demands for a more comprehensive understanding of the processes involved in the hydrological regime of lakes and channels in the Mackenzie Delta, has increased the need for more reliable remote monitoring systems. New instrumentation developments to meet future needs are discussed.

Time Lapse Photography - A Ten Year Update - J.A. Banner

When we take our beautiful instruments out of the laboratory and into the field, we find Murphy was right - Mother Nature is harsh. She attacks our handiworks with heat, cold winds, moisture and static electricity, then sends various animals to steal them, chew them up, and trample them into the mud.

Ten years of laboratory and field experience with time-lapse photography gave many opportunities to study Mother Nature's foibles and in some cases suggested ways of preventing or mitigating their more deleterious effects. A lot of experience has been gained in the field packaging of delicate instrumentations and camera systems.

WATER RESOURCES BRANCH
CHAIRMAN: K. WIEBE

WRB BRANCH OVERVIEW - K. WIEBE

If Water Survey of Canada is to continue to provide water quantity data to water resource managers and the user community in general in an efficient and cost effective manner, it will be required to automate its data collection, processing, communication and archiving activities. To achieve automation of the hydrometric data collection program, a system's approach must be used in formulating an equipment development plan.

The major problem in carrying out an equipment development plan is not the development of individual components but the integration of these components into an existing operation which, during its evolution into an automatic system, must continue to provide a product of consistent quality.

These integration problems may be partially offset by correct development sequencing and the development of equipment with sufficient flexibility to tolerate modifications in application. A plan which illustrates the sequence of WSC equipment development activity from 1982 to 1990 was shown and discussed.

Design Specifications for Water Survey Field Instrumentation - R. Terzi

The need for the Water Survey of Canada to provide water quantity data to user agencies on a real-time basis required that the instrumentation used for both acquiring and transmitting hydrologic information must operate in an effective and reliable manner.

To accomplish this, specifications were developed to ensure that instruments meet specific technical requirements and perform dependably under identified natural and induced environmental stresses during operation.

Additional testing is required to ensure that all instrument designs qualify under a quality assurance program. Testing criteria based on "Military Standard Climatic Extremes for Military Equipment" have been developed to minimize premature instrument failures and disruption in the collection of hydrologic data by the Water Survey of Canada.

Hydrometric Data Terminal - E.J. Fast

The Water Survey of Canada has been collecting hydrometric field data in a written format since 1908. All field notes to this date are handwritten, computed and checked through the use of electronic calculators and filed for future reference. This system has proven to be reliable and relatively error-free but inefficient and inaccessible for real time hydrological investigations.

In order to provide hydrometric field data in a real time computer accessible format, the development of a reliable, environmentally compatible hydrometric data terminal has been targetted as a priority. A contract will be let in September 1986 for four data terminals which will be evaluated by Water Survey of Canada regional staff. Based on this evaluation and a final specification prepared by Hydrometric Methods Section in Ottawa, production units will be purchased for field use.

Acoustic Flowmeter for Remote Areas - E.J. Fast

Accurate velocity measurement is necessary to produce reliable streamflow data. Hydrometric stations with stable stage-discharge relationships provide accurate reliable data using conventional methods.

Hydrometric stations located on rivers with variable flows and/or unstable stage-discharge relationships must be measured using unconventional techniques.

One such unconventional technique is velocity measurement using an acoustic flowmeter. To date, acoustic measurement techniques have been used successfully, but the reliability of the equipment because of outdated technology have curtailed its use.

The development of the micro-processor and environmentally compatible electronic components have greatly improved the reliability of the equipment and expanded its application.

Hydrometric Methods Section is presently involved in a development contract as a result of a U.P. for the development of an Acoustic Flowmeter for Remote Areas. The contract is to be completed by October 1986 when field testing of a prototype will commence. HMS is also negotiating with Stork Servex of the Netherlands for the development of an acoustic flowmeter, also for remote areas.

Power Supply Systems Hydrometric Gauging Stations - R. Terzi

Since the early 1960's electro-mechanical and electronic instrumentation has been used to gather hydrometric and other related data at gauging station sites. Initially, non-rechargeable batteries were used to supply power for these instruments. These proved less than satisfactory because of the uncertain power requirements and varying duty cycles of instruments at individual sites, the state of maintenance and adjustment of electro-mechanical instrumentation and the extemes in temperatures at which they are expected to function.

With the advances in photovoltaic technology and the ability of the devices to operate reliably for long periods in remote and often harsh environments, photovoltaic devices soon became an integral part of the power supply systems for the Water Survey of Canada Data Acquisition Program. The selection, testing and performance of suitable lead-acid batteries was also discussed.

Water Resources Branch Sediment Measurement Instrumentation - B. Tassone P&Y Region

The current instruments used by the Water Resources Branch to collect suspended sediment, bed load and bed material samples were presented. Applicability and limitations of the equipment were discussed. Research into and development of optical and acoustic instruments for the in situ measurement of suspended sediment concentrations is required.

Tavis P-25 VR Pressure Transducer Testing - R. Hardy, P&Y Region

An explanation of the ongoing field testing (in P&Y Region) of the Tavis P-25 variable reluctance pressure transducers.

A brief description of the transducer operating principals and special site requirements was presented. The testing to date was generally successful but certain concerns regarding the calibration parameters and specific areas for additional testing and interfacing were discussed.

APPENDIX

Attendees List

NATIONAL WATER RESEARCH INSTITUTE

Baird, S.D.	HD	(416) 336-4709
Beesley, D.	HD	336-4901
Bil, C.	HD	336-4521
Bisutti, L	HD	336-4878
Bull, J.	APSD	336-4920
Carey, J.	ECD	336-4693
Charlton, M.	AED	336-4758
Desrosiers, R.	HD	336-4902
DeZeeuw, N.	HD	336-4733
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Hawkins, M.	HD	336-4884
Healey, P.	TOD	336-4619
Hess, R.	TOD	336-4787
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Leppard, G.	AED	336-4787
Madsen, N.	HD	336-4263
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Peer, L.	HD	336-4893
Roy, F.E.	HD	336-4903
Salisbury, K.	HD	336-4878
Savile, H.	HD	336-4894
Smith, E.	TOD	336-4945
Stephens, R.	HD	336-4883
Strachan, W.	ECD	336-4775
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